PATENT ABSTRACTS OF JAPAN

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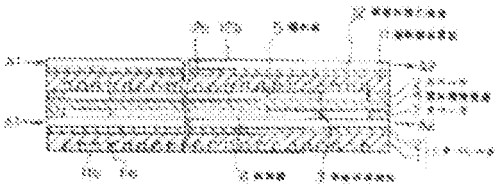
(54) SOLID ELECTROLYTE FUEL CELL

(57)Abstract:

PURPOSE: To completely prevent fuel gas and air from mixing so as to enable stable operation over a long period by providing an air electrode and a fuel electrode on one side and the other side of a separator, and providing an external or internal type manifold type structure for distributing oxidizer gas or fuel gas to the air electrode or fuel electrode.

CONSTITUTION: A fuel cell comprises flat unit cells 3 and separators 1 stacked alternately and is assembled as a stack. The separator 1 has the action of separating fuel gas and oxygen gas for use respectively in the fuel electrode 5 and the air electrode 6 of each cell 3, thereby preventing the cross leaks of the gases, and has the action of electrically connecting the unit cells 3 in series with one another. The separator 1 comprises a heat resistant metallic plate 11 made of Ni or an Ni alloy and a conductive oxide plate 12 which are stacked. The metallic plate 11 is used on the side of the fuel electrode 5 and the oxide plate 12 on the side of the air electrode 6. The metallic plate 11 has an internal manifold type structure in which fuel gas is distributed to the fuel electrodes 5. The oxide plate 12 has an external manifold type structure whereby air is distributed to the air electrodes 6 directly from outside the stack. A spacer 2 is inserted between the separator 1 and a solid electrolyte layer 4.



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CLAIMS

[Claim(s)]

[Claim 1]A plate-like cell which arranges a fuel electrode and an air pole so that it may face across a solid electrolyte layer, A separator which equipped the fuel electrode side of a cell with structure of an internal manifold type which is electrically connected to a fuel electrode in preparation for the air pole side of a cell in structure of an external manifold type which is electrically connected to an air pole and distributes oxidant gas to this air pole, and distributes fuel gas to this fuel electrode is laminated by turns. A solid electrolyte fuel cell constituting.

[Claim 2]The solid electrolyte fuel cell according to claim 1 making an air circulation groove which makes said separator a composite construction which consists of a refractory metal board and a conductive oxide board, and is established in a refractory metal board, and a fuel-gas-flow groove established in a conductive oxide board intersect perpendicularly.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to a solid electrolyte fuel cell.
[0002]
[Description of the Prior Art]These days, the fuel cell which transforms directly into electrical energy the chemical energy in which fuel originally has oxygen and hydrogen as an oxidizer and fuel, respectively attracts attention from viewpoints of saving resources, environmental protection, etc.
[0003]Using the zirconia which doped yttria etc. as an electrolyte layer, the solid electrolyte fuel cell using the lanthanum chromite oxide etc. as a separator has high operating temperature, generation efficiency is high, and by use of hot waste heat, since combined efficiency is high, research and development are progressing.
[0004]The plate-like cell which arranges a fuel electrode and an air pole so that a solid electrolyte fuel cell may face across a solid electrolyte layer, The separator which electrically connects an adjoining cell in series, and distributes fuel gas and oxidant gas to each cell is laminated by turns, and it is constituted as a stack (layer built cell) of a double layer. The structure which distributes fuel gas and oxidant gas to a cell is arranged to both sides of the separator, respectively. There are two kinds of these gas distributing structures, an outer manifold type and an internal manifold type, and the solid electrolyte fuel cell which has them is called the outer manifold type solid electrolyte fuel cell or the internal manifold type solid electrolyte fuel cell, respectively.

[0005]An internal manifold type solid electrolyte fuel cell is an integral-type structure where a separator has a function of oxidant gas, for example, air, and the air supply and exhaust of fuel gas, distribution, and an electrical link. Therefore, the hole of the air supply and exhaust of gas can open in the side part of a separator, air supply and exhaust of the gas is carried out to the electrode surface of a cell from this hole, and further, in order to distribute gas to all the corners of an electrode surface uniformly, and in order to connect a ****** cell in series, the slot and the projection are given to the electrode surface. The hole of gas air supply and exhaust can open in the periphery of the solid electrolyte layer of a cell, this hole is connected with a lengthwise direction in the process in which a cell and a separator are laminated, and each gas air-supply-and-exhaust passage is formed in the inside of a stack. In order to keep air from being mixed with fuel within a stack,

although there is the method of inserting a sealing compound into the sealing surface of a cell and a separator, a suitable material is not found, but there is the method of using ceramic adhesives as a sealing compound, but. If it pastes up thoroughly with ceramic adhesives, while producing distortion in jointing according to the difference of the thermal expansion of each component and causing a crack to the solid electrolyte layer of a cell, it becomes a cause of gas leakage generating by degradation of adhesives into the thermal cycle of multiple times. Although there is a method of using silica system glass about a sealing compound, the silica components in a sealing compound evaporate during long-term operation, and adhere and deposit on a low temperature part, and there is a fault which causes degradation of an electrode. Then, the method of making the spacer of zirconia or a refractory metal intervene at a sealed state between the peripheral edge part of the surface of a separator and the peripheral edge part of the solid electrolyte layer of a cell which meet the fuel electrode side of a cell as a mechanical seal method was developed. However, since the air-supply-and-exhaust hole of fuel and the air-supply-and-exhaust hole of air adjoin, there is a fault which is easy to carry out cross leakage.

[0006]An outer manifold type solid electrolyte fuel cell is form of providing the outer manifold for air, and the outer manifold for fuel gas in the periphery in order to supply air and fuel gas. In this outer manifold type solid electrolyte fuel cell, the corner part of a stack contacts a manifold tube. By this corner contact portion, air and fuel gas leak mutually, mix and burn, and a cell reaction falls. Then, a method of making rod-like glass placed between these corner contact portions, making it a molten state, and performing a seal, Although the method of pasting up an outer manifold on a stack with cement system adhesives, the method of crystallizing textile-glass-yarn adhesives, etc. were developed, there was a problem in the damage and heat-resistant cycle nature of an electrode by evaporation of a SiO ingredient.

[0007]

[Problem to be solved by the invention]It is not perfect, and as well as the efficiency of a fuel cell falling, it burns by mixing, a rise in heat is produced locally, thermal stress distribution becomes uneven, and such fuel gas and the conventional method of preventing mixing of air have become the cause of shortening the life of a stack. This invention was made in view of the above-mentioned point, and prevents mixing of fuel gas and air thoroughly, and an object of this invention is to provide the solid electrolyte fuel cell which can be stably operated over a long period of time.

[0008]

[Means for solving problem]The plate-like cell which arranges a fuel electrode and an air pole so that the solid electrolyte fuel cell of this invention may face across a solid electrolyte layer in order to solve an aforementioned problem, The separator which equipped the fuel electrode side of a cell with the structure of the internal manifold type which is electrically connected to a fuel electrode in preparation for the air pole side of a cell in the structure of the external manifold type which is electrically connected to an air pole and distributes oxidant gas to this air pole, and distributes fuel gas to this fuel electrode is laminated by turns. It is constituted.

[0009]

[Function]The separator used for the solid electrolyte fuel cell of this invention is provided with the structure of

the external manifold type which is electrically connected to the one side at an air pole, and distributes oxidant gas to this air pole, And since the feeding-and-discarding system of ring main was changed by having the structure of the internal manifold type which is electrically connected to a fuel electrode in the opposite side, and distributes fuel gas to this fuel electrode, it is isolated and oxidant gas and fuel gas are having the mixing prevented.

[0010]

[Working example]Hereafter, this invention is explained based on Drawings.

[0011]The perspective view seen from the slanting upper part of the separator with which drawing 1 is used for the sectional view of the solid electrolyte fuel cell of this invention, and drawing 2 is used for the solid electrolyte fuel cell of this invention, and drawing 3 are the perspective views seen from the slanting lower part of the separator used for the solid electrolyte fuel cell of this invention.

[0012]The solid oxide fuel cell of this invention laminates the plate-like cell 3 and the separator 1 by turns, and is assembled as a stack. The cell 3 arranges what coated MnO_3 for the nickel/YSZ cermet by screen-stencil etc. as the air pole 6 (La, Sr) as the fuel electrode 5 so that it may face across the solid electrolyte layer 4. The solid electrolyte layer 4 is built with the zirconia sintered compact (YSZ) which doped yttria etc. The air-supply-and-exhaust hole of gas has opened in two corners of the diagonal direction of the solid electrolyte layer 4. This gas air-supply-and-exhaust hole is the same as that of the size of the air-supply-and-exhaust hole 1a 1a of two corners of the separator 1, i.e., a breakthrough, and arrangement which are mentioned later.

[0013]The separator 1 has the operation which separates the fuel gas and oxidant gas which are used for the fuel electrode 5 and the air pole 6 of the cell 3, respectively, and prevents those cross leakage, and the operation which electrically connects cell 3 comrade in series. The separator 1 is constituted as a complex on which the refractory metal board 11 built with nickel, a Ni group alloy, etc. and the conductive oxide board 12 were piled up, uses the refractory metal board 11 for the fuel electrode 5 side, and uses the conductive oxide board 12 for the air pole 6 side. The upper surface of the refractory metal board 11 serves as the pocket section 11c which central [a part of] was dented and had the even bottom, and the conductive oxide board 12 as a collecting section is inserted in this pocket section 11c in the direction of arrow F. When it inserts in, the even bottom of the pocket section 11c of the refractory metal board 11 and the even undersurface of the conductive oxide board 12 are piled up, and it becomes a joining interface.

[0014]In order for the refractory metal board 11 to make rectangular shape mostly, and for the air-supply-and-exhaust hole 1a of fuel gas to be able to open it in two corners of a diagonal direction and to distribute fuel gas to the 5th page of the whole electrode of the cell 3 uniformly further, And in order to connect the ****** cell 3 in series, the fuel-gas-flow groove 11a of plural lines and the projection 11b are given to the 5th page of the electrode. The fuel-gas-flow groove 11a is formed in the longitudinal direction of the separator 1 (refer to drawing 3). When a fuel cell is assembled, the projection 11b contacts the fuel electrode 5 of the cell 3, is conducted electrically, and forms a power generation part. The slot 11a is open for free passage through 11 f of craters currently formed in the surface of the refractory metal board 11 to the air-supply-and-exhaust hole 1a of the fuel gas of the diagonal direction of two right and left (refer to drawing 3). If it puts in another way, the distributing structure of fuel gas will be an internal manifold type. Therefore, the air-supply-and-exhaust hole 1a

of fuel gas. the fuel-gas-flow groove 11a, the projection 11b, and 11 f of craters are named the structure of the internal manifold type which is electrically connected to a fuel electrode and distributes fuel gas to this fuel electrode generically. The peripheral edge part 11d of the surface of the refractory metal board 11 serves as a sealing surface which laps with the solid electrolyte layer 4 of the cell 3, or the spacer 2 (refer to drawing 1). Fuel gas is supplied to the separator 1 in the arrow B1 direction, and is discharged by the arrow B 2-way.

[0015]The conductive oxide board 12 makes a square mostly, for example, carries out application-of-pressure molding of the strontium dope lanthanum chromite, and calcinates and obtains it in the air, the upper surface is equipped with the circulating groove 12a of oxidant gas, for example, air, and the projection 12b, and the undersurface is a flat side. The circulating groove 12a of air and the projection 12b are outer manifold types which are formed crosswise [of the separator 1] (it is a transverse direction to a longitudinal direction axis line) from an end to an end, and distribute air from the outside of a direct stack. The circulating groove 12a of air and the projection 12b are named structure of an external manifold type which is electrically connected to an air pole and distributes oxidant gas (air) to this air pole generically. Oxidant gas is supplied to the separator 1 in the arrow A1 direction, and is discharged by arrow A 2-way.

[0016]The spacer 2 is inserted between the separator 1 and the solid electrolyte layer 4. The spacer 2 was made with ceramics or metal plates, such as zirconia of 100 microns of thickness numbers, and an air-supply-and-exhaust hole of fuel gas has opened it in the two corners. This air-supply-and-exhaust hole has same size and arrangement as the air-supply-and-exhaust hole 1a of the separator 1.

[0017]Since the air circulation groove 11a which makes the separator 1 a composite construction which consists of the refractory metal board 11 and the conductive oxide board 12 in the above-mentioned embodiment, and is established in the refractory metal board 11, and the fuel-gas-flow groove 12a established in the conductive oxide board 12 are made to intersect perpendicularly, A position of an air-supply-and-exhaust hole of air and fuel gas can be made to be able to isolate certainly, and both mixing can be prevented further.

[0018]In the above-mentioned embodiment, although the separator 1 was explained as a complex separator which piled up the refractory metal board 11 and the conductive oxide board 12, when the separator 1 is not made into a compound expression but it makes on a single object, this invention can be carried out similarly.

[0019]

[Effect of the Invention]As explained above, according to this invention, form in the structure of an external manifold type the structure which is electrically connected to an air pole and distributes oxidant gas to this air pole, and it is provided in the separator surface by the side of an air pole, And since formed in the structure of an internal manifold type the structure which is electrically connected to a fuel electrode and distributes fuel gas to this fuel electrode, it provided in the separator surface by the side of a fuel electrode, the position which supplies and discharges fuel gas and air to a fuel cell was made into another system and it isolated, the following extremely outstanding effects are acquired.

(1) The solid electrolyte fuel cell of an inside and external compound manifold structure can be obtained easily.

(2) Since fuel gas and oxidant gas are well separated as compared with the independent system of the conventional manifold or an outer manifold, the solid electrolyte fuel cell which a possibility that ring main may

mix and burn decreases, and the capacity factor of fuel improves, and can be stably operated over a long period of time can be provided.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a sectional view of the solid electrolyte fuel cell of this invention.

[Drawing 2]It is the perspective view seen from the slanting upper part of the separator used for the solid electrolyte fuel cell of this invention.

[Drawing 3]It is the perspective view seen from the slanting lower part of the separator used for the solid electrolyte fuel cell of this invention.

[Explanations of letters or numerals]

1 Separator
1a Breakthrough
2 Spacer
3 Cell
4 Solid electrolyte layer
5 Fuel electrode
6 Air pole
11 Refractory metal board
11a Fuel-gas-flow groove
11b Projection
11 d Peripheral edge part
11f crater
12 Conductive oxide board
12a Oxidant gas circulating groove
12b Projection

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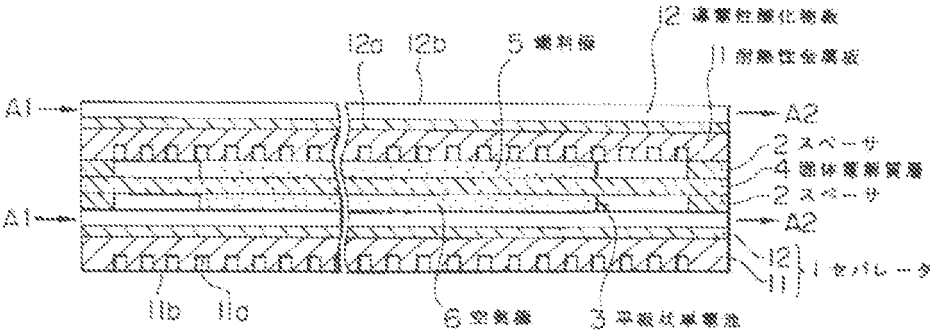
DRAWINGS

[Drawing 1]



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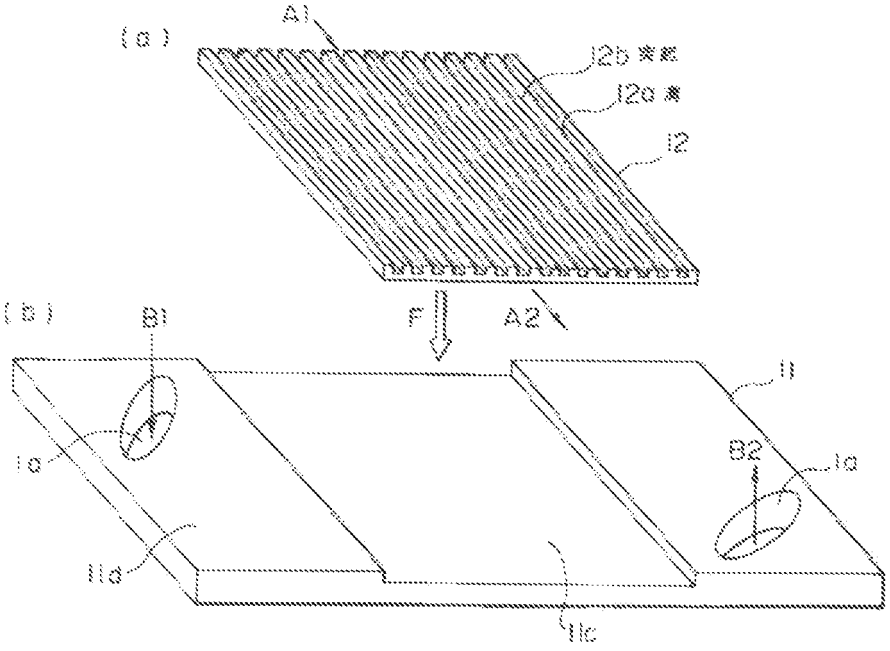

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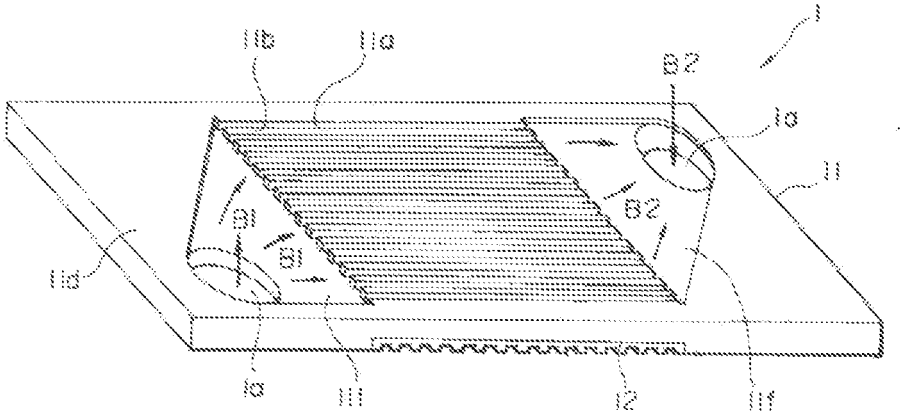

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